

***Grevillea tetragonoloba* (Proteaceae: Grevilleoideae) recircumscribed,
with notes on its typification and a new segregate species,
Grevillea nivea, described**

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Abstract

Olde, P.M. & Marriott, N.R. *Grevillea tetragonoloba* (Proteaceae: Grevilleoideae) recircumscribed, with notes on its typification and a new segregate species, *Grevillea nivea*, described. *Nuytsia* 19(2): 229–243 (2009). *Grevillea nivea* P.M.Olde & N.R.Marriott is the third species that we have segregated and described from *Grevillea tetragonoloba* Meisner *sensu* McGillivray. The type citation of *Grevillea tetragonoloba* is discussed and modified. Recognition of *Grevillea nivea* as distinct from *Grevillea tetragonoloba* requires a modified circumscription for the latter species, and a full, updated description is provided here. A key is provided enabling distinction from closely related species.

Introduction

Grevillea tetragonoloba was described by C.F.Meisner (Meisner 1856: 374). Soon after its formal publication, Bentham placed it in synonymy under *Grevillea hookeriana* Meisner (Bentham 1870: 432). From that time, *Grevillea tetragonoloba* generally remained confused with *Grevillea hookeriana* until lectotypification of both species by Don McGillivray in 1993 (McGillivray & Makinson 1993: 420, 444) when they were re-established as distinct species. In the same monograph, McGillivray recognised *Grevillea tetragonoloba* as constituting five races (McGillivray & Makinson 1993: 71–72), leaving two specimens unassigned. All races are distributed in south-west Western Australia, roughly from the southern coast north to Woogenilup in the west and the Jerdacuttup River catchment near Ravensthorpe in the east. In 1994, the present authors revised the McGillivray arrangement. Three of McGillivray's races were formally recognised and described as two species and one subspecies, respectively 'race e', the short-lobed race *sensu* McGillivray, as *Grevillea fastigiata* P.M.Olde & N.R.Marriott, 'race d', the digitate race, as *Grevillea rigida* P.M.Olde & N.R.Marriott subsp. *rigida*, and 'race c', the pectinate race, as *Grevillea rigida* subsp. *distans* P.M.Olde & N.R.Marriott (Olde & Marriott 1994d: 186–187). One unassigned specimen, Rogerson 332 (PERTH 02439603), was treated as an intermediate between the two subspecies of *Grevillea rigida*. Recognition of two races in a more narrowly circumscribed *Grevillea tetragonoloba* was continued (Olde & Marriott 1995b: 199–200). The two races retained were 'race a', the narrow-lobed race, and 'race b', the blunt-lobed race *sensu* McGillivray.

At that stage, 'race b' had not been seen by us in the field. The few dried specimens seen of 'race b' were mostly rudimentary. Our taxonomy was also confounded by living plants we had seen along West River Road, Fitzgerald River National Park that we assumed to be part of 'race b' (Olde 1988:

11) but which later proved to be a hairier, grey-leaved form of 'race a'. The misidentification led us to the belief 'that these two races do not warrant formal separation at this stage' (Olde & Marriott 1995b: 200). Makinson (2000: 72–74) continued recognition of the taxa erected by us but more correctly observed that *Grevillea tetragonoloba*, in which two forms were recognised, remained 'somewhat variable'.

Field work conducted by us in 1999 clearly showed correctly identified plants of 'race b' to be specifically distinct from 'race a'. In particular, we were struck by the snowy white indumentum on the branchlets, perianths and floral rachises, the bright red flowers and the coarser and more numerous leaf lobes, some with secondary division, all of which characters differed in populations of *Grevillea tetragonoloba*. It also confirmed conspecificity of 'race b' with a plant introduced to cultivation by John Cullen in 1992 from a plant collected at Hood Point (NSW 273561). The new introduction, here described as *Grevillea nivea* P.M. Olde & N.R. Marriott, has been sold as *Grevillea* 'Scarlet King'. Separation of 'race b' restricts the delimitation of *Grevillea tetragonoloba* yet further, and a full revised description is here included.

Grevillea tetragonoloba and *Grevillea nivea* are members of our Group 35 (the *Asplenifolia Hookeriana* Subgroup of the *Pteridifolia* Group *sensu* Makinson 2000), a large group of grevilleas distinguished by having the ovary densely hairy, the adaxial surface of the perianth glabrous and fruits with reddish markings. Most of the group, though not all, have secund conflorescences and some have hairs behind the anthers.

Morphology and Terminology

Species description format and morphological terminology follow McGillivray and Makinson (1993), with some modifications based on Hewson (1988) and Hickey (1973). Our own modifications and clarifications to terminology, definition of species concept, and methods of working are outlined in Olde & Marriott (1993a, 1993b, 1994a, 1994b, 1994c, 1994d, 1995b, 2002, 2008). In this paper, we have prepared the descriptions initially from plants cultivated in the garden of one of the authors (Olde). These descriptions were then compared with dried specimens at CANB, MEL, NSW and PERTH and the descriptions modified where applicable. Herbarium abbreviations follow Holmgren *et al.* (1990).

Indumentum. Although the definitions of classical indumentum character states provided by Hewson (1988) are useful, we have come to the conclusion that, in most instances, they are too generalised to convey sufficiently precise information. McGillivray and Makinson (1993: 1–2) have described three types of hair in *Grevillea*, biramous, multicellular-glandular and papilloid. The first two types are uniseriate. Biramous or 'two-armed' hairs are restricted to the Proteaceae and are especially common in *Grevillea*. They have the ultimate of three cells two-branched, the arms equal or not in length, oriented at diagnostic angles, variable in thickness, shape, sheen and coursing and sometimes, with diagnostic colour content or colour changes. Multicellular or possibly sometimes unicellular, glandular hairs are simple, and may exude a viscous drop at the tip. After drying, they are scale-like, and often leave dried exudate in the form of resinous particles or, in one case described here, waxy globules. The presence or absence of glandular hairs is extremely diagnostic. Sometimes the two uniseriate hair types are mixed together in diagnostically important proportions and density. Hairs of different length and arm orientation may similarly be intermixed in diagnostic patterns. Classical terminology does not adequately address this variation. Weston (1994) used separate descriptive terms for each attribute

and, by following this, better discrimination between taxa has resulted in our work. Definitions of hair density, length, orientation are also provided by Weston. In measuring hair length we understand his definition of short, medium and long to refer to the length of both arms in combination. He has used the term 'curly' to describe biramous hairs without any specifiable angle, whereas we use this term when hairs are curled in circular formation. We use the terms 'wavy' or 'sinuous' when hairs exhibit undulate or irregular coursing or 'straight' when straight. When intermixed with biramous hairs, glandular hairs may be difficult to see if present in small numbers. They can be seen readily *in vivo*. In dried specimens, they can usually be recognised by their simple nature, their flatness or lack of body, their blunt tip or by attached, dried exudate, though care must be taken to distinguish this from sand and dirt particles.

Proximal rachis segment. In pinnatipartite (subpinnatisect) leaves the distance between the point of attachment of the petiole to the branchlet and the proximal lateral lobes has proved quite diagnostic. This section of what is the primary leaf rachis is here termed the 'proximal rachis segment'. In some groups of *Grevillea*, other characters have been introduced to further qualify this area of the leaf.

Conflorescence buds. Shape and size of floral buds is a neglected area of taxonomy in *Grevillea*. Buds constitute the primary phase of conflorescence development and close examination has proved to be extremely diagnostic in this and other species groups under study. The definition of a conflorescence bud is here restricted to the development phase when floral bracts firmly enclose the developing flowers. The bud begins to disintegrate as a recognisable unit when the bracts change orientation or fall and individual flowers elongate between them as they develop into a mature conflorescence. The point at which maximum bud maturity is reached occurs just prior to disintegration. In the current study this is achieved when elongation of the bud has reached *c.* 1.5 cm, at which length both shape and size are maximised and measurements have been made for comparison.

Pedicel. Pedicel width, not measured in any revisions to date, varies greatly between species, especially species groups, and may prove diagnostically useful. We have included this measurement as well as expanding the description of the pedicel itself.

Perianth limb. McGillivray and Makinson (1993: 2–4) recognised and illustrated three states of perianth orientation; erect, nodding and declined. In the *declined* position, depending on whether the curve or neck of the perianth tube elongates, the limb may turn down closely beside the perianth tube or through extension of the curve hang free away from the tube. In this context, we recognise the limb as either *closely declined* or *loosely declined*. We also recognise an additional state of recurvature, the *revolute* position, when the limb continues turning and the apex of the limb is directed at right angles back towards the ventral surface of perianth tube. Varying degrees of orientation are indicated by hyphenation e.g. declined-revolute, when the limb is not fully revolute but almost so.

Left and right. During ontogenetic development, the perianth limb may become laterally displaced from the dorsiventral axis of the perianth, either to the left or right. Accordingly, left and right are determined when the flower is held by the pedicel with the ventral suture facing away from the body, equivalent to stage-left in theatre i.e. to the left with respect to the performer, not the audience. In the same way, it may be diagnostically important to distinguish the sides of an irregular conflorescence. The left side of the floral rachis is determined similarly with the apex of the rachis facing away when holding it by the proximal, leafy end. Although floral orientation is said here to be acroscopic for both species, the dorsiventral axes of the perianths do not strictly face squarely towards the apex of the rachis but rather, face slightly to the left for flowers on the left of the rachis and slightly to the right for flowers on the right side of the floral rachis.

Taxonomy

1. *Grevillea tetragonoloba* Meisner, in A.L.P.P. de Candolle, *Prod.* 14: 374 (1856). Type: 'Swan R. Colony' [Western Australia], *Drummond* coll. 5 n. 282! (*lecto*, *fide* McGillivray in McGillivray & Makinson (1993: 444): NY 00284714, photo seen; *isolecto*: CGE (*n.v.*), Fl(*n.v.*), G (*n.v.*), K, LE (*n.v.*) MEL, NY 00284713, photo seen).

Grevillea tetragonoloba 'race a' the narrow-lobed race *sensu* McGillivray (McGillivray & Makinson 1993: 71–72).

Grevillea tetragonoloba fine-leaf (typical) form *sensu* Olde & Marriott (1995b: 200).

Grevillea tetragonoloba narrow-lobed form *sensu* Makinson (2000: 72–73).

Seedling (McGillivray 3511 NSW 297360) cotyledons not seen; branchlets with waxy globules; first three seedling leaves 2 cm long, 1 cm wide, obovate-cuneate, apically dentate, almost glabrous on both surfaces except for glandular excrescences and scattered appressed biramous hairs, the margins flat to shortly recurved; leaves 4–7 deeply pinnatifid to 3–5-partite, the lamina increasingly more deeply dissected with lobes narrow-triangular, and margins more strongly revolute; leaves 8+ closely approaching the adult, the lamina abutting the midvein on the abaxial surface, the sulcae sometimes filled with waxy globules. *Adult plants* stenobasic, fire-sensitive, dense *shrubs* 1.5–2.6 m high, 2–4 m wide with spreading to ascending branches; branchlets angular, becoming rounded with age, with prominent ribs decurrent from the leaf bases extending down past lower nodes; youngest branchlets striate, the indumentum creamy- or reddish-fawn to coppery with ferruginous ribs, greyish with age, dense between the ribs, sparse to moderately dense on the ribs, the hairs biramous and glandular, mostly short, straight or slightly sinuous, closely appressed and mutually aligned, with occasional hairs ascending. New growth fawn-brown. *Leaves* green, occasionally greyish, usually divided, rarely simple; divided leaves 6–13 cm long, 4–8 cm wide, strongly ascending, sessile to shortly petiolate, subsecund, gently incurved, wide-spaced to moderately crowded, obovoid in overall outline, most usually pinnatipartite with the proximal lobes lacking secondary division, the apical lobes sometimes bi- or tripartite; primary leaf lobes (2–)5–8; primary leaf lobes and simple leaves 2.5–7.5 cm long, (0.8–)1–1.5 mm wide, linear to subulate, straight to slightly incurved, tetragonous in cross-section, the terminal lobe simple or sometimes bisect; proximal rachis segment 1.5–4 cm long, linear; apices of lobes acute with blunt, scarcely pungent mucro 0.5–0.7 mm long; margin twice refracted about longitudinal intramarginal veins, the first refraction roughly at right angles, the second at right angles or oblique, usually enclosing the abaxial surface and either tightly abutting the midvein on the narrowest lobes or, on broader leaves, with a narrow (*c.* 0.05 mm wide) hair-lined sulca on each side of the midvein; adaxial surface usually convex, smooth, sometimes with irregular longitudinal wrinkling or ribs on either side of the midvein, subglabrous or with a sparse (moderately dense when young) indumentum of short, semi-appressed, white or rusty, wavy biramous hairs, occasional longer hairs and short glandular hairs or resinous deposits intermixed, the proximal rachis segment similar, the hairs dense on and just above the petiole; abaxial surface of lobes angularly concave to flat, enclosed by the margin, the midvein glabrous, or sometimes with a sparse indumentum of appressed, usually wavy, white or rusty hairs, sometimes hairs with black or red contents intermixed and mostly aggregated in the sulcae; venation of adaxial surface with the midvein and intramarginal veins translucent, prominently raised, smooth to faintly granular, on the abaxial surface the midvein prominent but recessed below the subtending intramarginal veins; texture coriaceous. *Conflourescence* 6–8(–10) cm long, 1–2 cm wide at anthesis but ultimately up to 5 cm wide post anthesis, 2.5–3 cm high (*in vivo*) from rachis to style-ends, terminal or more frequently subterminal, erect on the peduncle but usually

ascending relative to the shrub, usually simple, sometimes terminal confluences 1–3-branched at base, shortly pedunculate, narrowly conico-secund when the first flowers reach anthesis, later subhemispherical with the lateral flowers spreading in an almost horizontal plane, dense, acropetal; buds at 1.5 cm long, 2–2.5 mm wide, cylindrical; peduncles usually bracteate, 1–2 cm long, greyish-rusty, sericeo-tomentose with scattered glandular hairs intermixed; floral rachises 2–2.3 mm thick at base, striate, ferruginous alternating with white hairs, the latter colour predominant, silky-tomentose with glandular hairs and usually waxy globules *c.* 0.02 mm diam. intermixed, the apical 1 cm usually without flowers by abortion of young buds; confluence bracts 1.5–2.5 mm long, obovate; floral bracts *c.* 1 mm long, *c.* 2 mm wide, ferrugineo-sericeous outside, broadly obovoid with strongly incurved apex, glabrous inside, falling as the confluence expands. *Flowers* ferruginous on the limb in bud; at anthesis, the perianth outside grey-white with bronze-tinged hairs intermixed, limb ferruginous; perianth inside red at the curve and on dorsal tepals, elsewhere black-red; style yellowish above the ovary, Guardsman red (RHS 45A) elsewhere; style-end yellowish-red; pollen-presenter yellowish-red; pollen translucent with reddish tinges; nectary yellow with reddish infusion on exposed parts of the lower side, ageing to ochre-yellow; orientation in bud adaxially acroscopic, at anthesis acroscopic, post-anthesis adaxially acroscopic; pedicels 1.2–2 mm long, 0.7 mm wide at base expanding to 1 mm wide below the torus, recurved to erect before anthesis, ultimately strongly antrorse, stout, obovoid, tomentose with glandular hairs and waxy globules intermixed; torus 1.8 mm across, slightly oblique at *c.* 10° to transverse; nectary 0.7–1.5 mm long, 1.4 mm wide, 0.2–0.3 mm thick, patelliform-linguiform, concave proximally, extending *c.* 0.2–0.4 mm laterally beyond the torus, the apex truncate to broadly acute, recurved with age. *Perianth tube* 6–6.5 mm long, (1.8–)2–2.3 mm wide, zygomorphic, obliquely ovoid-sigmoid, dilated at base, the abaxial surface with a dense indumentum of biramous and scattered multicellular, glandular hairs intermixed with waxy globules, the hairs medium, dull to subshiny, straight, appressed; the adaxial surface glabrous, the style-end tightly enclosed before anthesis, all tepals separating and quickly falling after anthesis; limb 1.5–1.75 mm long, 1.8 mm wide, spheroidal, symmetrical, closely declined to declined-revolute, flowers on the left side of the rachis with limb sinistrally displaced at anthesis, those on right hand side dexterously displaced, sericeous to subsericeous with medium hairs bearing rusty contents; dorsal tepals 9.5–10 mm long, 1.5–1.7 mm wide at base, 0.7 mm wide at curve. *Pistil* 19–25 mm long; stipe 0.2–0.4 mm long, subvillous, mostly enclosed in the torus; ovary *c.* 1.3 mm long, *c.* 1.1 mm wide, obliquely ovoid, subsessile, densely subvillous with long, straight, slightly spreading, white hairs; style strap-like *in sicco*, terete *in vivo*, *c.* 0.7 mm wide at the curve, gradually dilated to 0.8 mm wide below the style-end, *in sicco* with few to many short multicellular trichomes especially at the half-way curve, *in hort.* (Olde 08/01 [NSW], Maiden s.n. (NSW 92136) with numerous, short, simple, ?multicellular glandular hairs and minute trichomes throughout, glandular hairs moderately dense on the ventral surface about the curve, emergent and looped up before anthesis, erect with slight incurvature from *c.* halfway at anthesis but soon strongly retrorse from halfway to sigmoid, ultimately the proximal half of the style antrorse and slightly oblique to almost parallel with the rachis, the distal coursing unchanged; style-end abruptly divergent 0.5 mm below the end and expanded to 1.5 mm in width, glabrous; pollen-presenter 1.3 mm long, 1 mm wide, oblique at *c.* 5°–10° encircled by an undulate style-end *in sicco*, round–elliptical, flat to slightly convex with one prominent radial rib extending proximally from the stigma and three distally, the margin and surface undulate; stigma prominent, annular, distally off-centre, surrounded by minute trichomes. *Fruits* 10–15 mm long, 5–7 mm deep, erect on strongly incurved pedicels, the dorsal suture adjacent to the rachis during the growth phase, ultimately rotating on its axis away from the rachis before dehiscence, obliquely ovoid–oblong to ellipsoid with erect or decurved apical attenuation *c.* 2 mm long; styles persistent; abaxial surface densely sericeous or subsericeous, glandular hairs or waxy globules very occasional to absent, longitudinally ribbed on the dorsal side and with irregular longitudinal, reddish-dark purple stripes confined to the dorsal side; surface beneath the indumentum slightly irregular and somewhat colliculose; adaxial surface smooth; pericarp 0.3–0.5 mm across at the suture, texture crustaceous. *Seeds* 8–10 mm long, 4 mm wide, 2 mm thick, obovoid-elliptical with

a curved outer edge and straight inner edge; abaxial face convex, glossy, almost smooth or slightly wrinkled, consisting of a central elliptic portion 7.5 mm long, 3.5 mm wide surrounded by a darker, narrow, rib-like border 0.25 mm wide and an outer, lighter-coloured margin 0.5–0.8 mm wide along the sides, up to 1 mm wide on the ends; adaxial face with an inner, flat, minutely tessellated, elliptic segment 7 mm long, 1.25 mm wide, surrounded by a dark border *c.* 0.3 mm wide, the border lacking vertically descending outer margin, all surrounded by a creamy-white waxy border *c.* 0.5 mm wide along the sides, 0.5–0.8 mm wide at base, the elaiosome 1–1.5 mm long and drawn to an obtuse point at the other end. (Figure 1)

Selected specimens (35 examined). WESTERN AUSTRALIA: Ongerup–Ravensthorpe Road, 25 km E of Ongerup, 17 Sep. 1990, *D.E. Albrecht & B.A. Fuhrer* 4516 (PERTH 04245113); intersection of Corackerup Rd & Cowalellup Rd, between South Stirling and Ongerup, 18 Feb. 1998, *L.W. Cayzer* 557, *G.T. Chandler & S. Donaldson* (AD, CBG 9805323, PERTH); Cape Riche Rd, off Hassell Highway, Wellstead, 14 Oct. 1988, *E.J. Croxford* 6113 (PERTH 04136926); 8 km E of Maringup South Rd [Maringarup Rd] and Devils Creek Rd junction, 28 km E of Gairdner, 30 Nov. 1985,

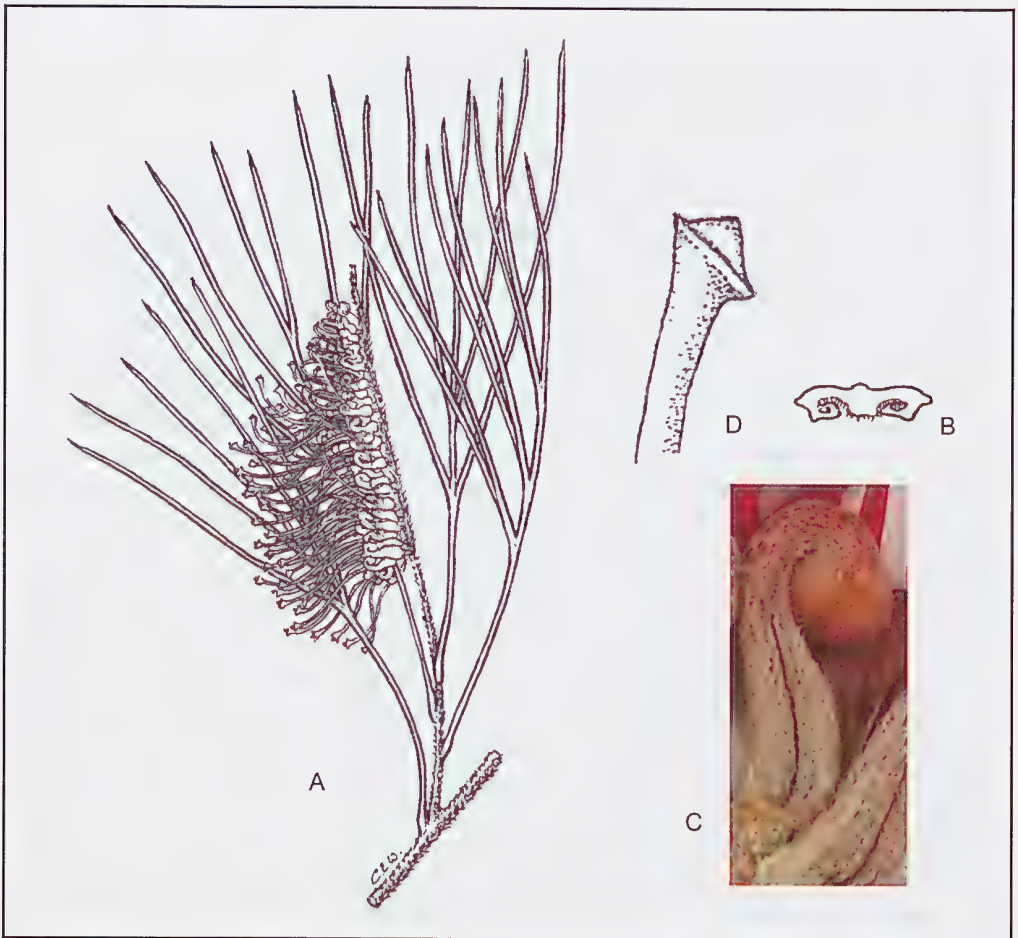


Figure 1. *Grevillea tetragonoloba*. A – unit conflorescence and foliage (×0.5); B – leaf lobe in cross-section (×20); C – perianth and pedicel, showing white, waxy globules around curve at top and on pedicel (×7); D – style-end (×15). Illustrations by the late Collin Woolcock. Colour image scanned with the assistance of Miguel Garcia and Paivi Lindsay at NSW.

D.B. Foreman 1361 (CANB 371641, NSW 388352, PERTH 1844083); near Cape Riche, 11 Oct. 1942, *C.A. Gardner* 6508 (PERTH 01844733); Hassell Highway, between the Boat Harbour turn-off and Pallinup River, c. 3 km S of the river, 25 June 1976, *D.J. McGillivray* DJM 3502 & *A.S. George* (CANB 00478043, PERTH 01844164); Melbourne Botanic Gardens, Sep. 1899, *J.H. Maiden* s.n. (NSW 92139); neighbourhood of Albany and King George's Sound, 1874, *G. Maxwell* 73 (NSW 399766 ex *Hb. J. Cosmo Melvill*); Needilup Hill, 6 Apr. 1963, *K. Newbey* 731 (PERTH 02439565); 11.3 km S on Toompup South Rd, Toompup, 11 Oct. 1991, *P.M. Olde* 91/293 (NSW 535412); Nyabing Rd, 25 km N of Jerramungup–Broomehill Road, 11 Oct. 1992, *P.M. Olde* 92/270 (NSW 535406); Knights Rd, Woogenilup, c. 10 km N of Porongurup, 18 Oct. 1999, *P.M. Olde* 99/300 & *P. Luscombe* (NSW 534612, PERTH 06487610); cultivated, Oakdale, New South Wales 18 Feb. 2008, *P.M. Olde* 08/01 (NSW); Hamersley Rd, Fitzgerald River National Park, 6 Dec. 1997, *R. Schuh* 97-18, *G. Cassis* *et al.* (PERTH 05099854); 16 km S of Jerramungup, 24 Oct. 1982, *A. Strid* 20992 (NSW 388351); W. Australia, 1896, *L. Webster* per *C. Walter* s.n. (NSW 92136).

Distribution. Western Australia, South-west Botanical Province, Esperance Plains IBRA. Most populations are within 50 km of Highway 1 between the points intersected by the Pallinup River in the west and West River in the east. Outlying populations are recorded from near Cape Riche and Woogenilup. (Figure 2)

Habitat. Occurs along open, rocky creek-lines or adjacent heath among granite boulders where it is usually dominant in shrubland.

Flowering period. Spring.

Fruiting period. Late spring–summer.

Conservation status. Conservation Code for Western Australia: Priority Two.

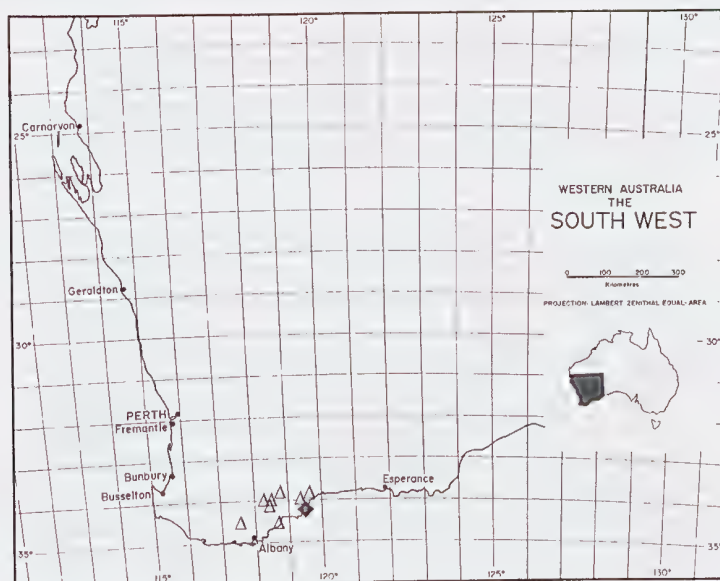


Figure 2. Distribution of *Grevillea tetragonoloba* (\triangle) and *Grevillea nivea* (\blacklozenge) in Western Australia.

Affinities. See *Discussion* under *Grevillea nivea*, its closest relative. *Grevillea tetragonoloba* has been confused with *Grevillea hookeriana*, which differs in having yellow-green leaves with smoothly revolute leaf margins and with the adaxial surface smoothly convex with venation obscure, pistils 18–21.5 mm long (except rarely a woodland population in Dryandra Forest to 23 mm long) and styles usually black or red-black, rarely yellow.

Note on typification. The name *Grevillea tetragonoloba* was first used by Meisner in 1852 within a long list of *Proteaceae* collected by James Drummond. The list was published in William Hooker's *Journal of Botany & Kew Gardens Miscellany* (Meisner 1852: 186). There the name, like many others, was a *nomen nudum* but Meisner indicated that the 'species and *var. ineditae* marked MSS' would be 'found characterized in the forthcoming volume of De Candolle's *Prodromus*' (*ibid.*: 182). The formalities were completed in 1856, as indicated (Meisner 1856: 374).

In an attempt to bring some order to Drummond's specimens, Meisner (1852) listed Roman numbers alongside each plant, according to the batch as they had 'successively been received in Europe'. To the collection of *Grevillea tetragonoloba* and others (e.g. *Grevillea armigera*) he erroneously recorded the Collection series as IV. Hooker submitted the list prior to publication to the Librarian of the Linnean Society, Richard Kippist (1812–1882) who, among other recommended changes, 'took 'the liberty of prefixing the date (1848) to those which I found marked in my list as belonging to the fourth collection.' (*ibid.*: 181). The presumption that Drummond specimens collected in 1848 were part of his fourth collection continued until Erickson clearly demonstrated that it was part of his Fifth Collection, all specimens of which were despatched by Drummond in July 1849 (Erickson 1969: 168). The specimen was received in Europe (*nob. [nobis]* - to us) on 4 June 1850.

The lectotype (*fide* McGillivray, in McGillivray & Makinson 1993: 444) of *Grevillea tetragonoloba* is NY 00284714. There is also an isotype at NY. The only words attaching to the original type specimen were Drummond ['Drumond'] 282!. The protologue (Meisner 1856: 374 No. 100) of *G. tetragonoloba* adds the words *In colonia Swan River (Drumm. coll. 4, n. 282!)*. At the end of the description Meisner cites specimens seen in the herbaria of Robert James Shuttleworth (1810–1874) and Dr Charles Morgan Lemann (1806–1852) (*v. s. in herb. Shuttl. et Lemann*).

The lectotype sheet itself now contains the following words, in Meisner's script:
Grevillea (Calothyrsis) tetragonoloba nob. (4 Jun. 1850) Drummond (Coll. 1848) n. 282! in hb. Shuttleworth.

Notwithstanding Erickson's work, the lectotype of *Grevillea tetragonoloba* continued to be cited by all recent revisions as 'Swan R. colony, W.A. *J. Drummond* coll. 4, no. 282! (1848)' (McGillivray & Makinson 1993: 444; Olde & Marriott 1995b: 199; Makinson 2000: 72).

Drummond made several collecting trips to the south coast during his collecting career. All collections except his second and sixth contained specimens from the area. In addition to his famous collecting trip in 1846–47 with George Maxwell, after he had been awarded the Queen's Bounty, Drummond's 1848 expedition to almost the same area on the south coast was also made with George Maxwell (Olde & Viol in prep.). The collection citation *Drummond* Coll. 4, 1848 is therefore incorrect in two respects and should be modified, acknowledging Barker & Barker (1990), as 'Swan River colony, *Drummond [Drumond]* (Coll. V) n. 282! & *Maxwell* (1848)'.

It is interesting to note, among the general confusion, that other collections such as *Isopogon latifolius* and *Grevillea nudiflora* listed by Meisner (1852), which must have been made and sent at the same time as *Grevillea tetragonoloba*, were included in Collection V, according to the same list (Meisner 1852: 183, 186).

2. *Grevillea nivea* P.M. Olde & N.R. Marriott, *sp. nov.*

Affinis *Grevilleae tetragonolobae* Meisner sed pilis glanduliferis absentibus, ramulis niveis, foliis brevioribus (4.5–5.5 cm longis), lobis plerumque pluribus (9–15), brevioribus (1.5–4.5 cm longis), parum latioribusque (1.5–1.8 mm latis), ad basem 2–2.5 cm supra petiolos insertis saepe bi-divisis, sulcis abaxialibus circa 0.15 mm latis dense pilosis, apicibus obtusis, mucronibus brevioribus (0.3 mm longis), pilis rhachidum niveis, bracteis florum longioribus latioribusque (1.5 mm longis, 2 mm latis), globulis ceraceis in rhachidibus, pedicellis et perianthiis absentibus differt.

Typus: Doubtful Island Bay, Western Australia [precise locality withheld for conservation reasons], 18 October 1999, P.M. Olde 99/138 & N.R. Marriott (*holo*: PERTH 07862288; *iso*: AD, BRI, CANB, K, MEL, NSW, NY, PERTH 07862261, US).

Grevillea tetragonoloba 'race b' blunt-lobed race *sensu* McGillivray (McGillivray & Makinson 1993: 71–72).

Grevillea tetragonoloba blunt-leaf form *sensu* Olde & Marriott (1995b: 200).

Grevillea tetragonoloba blunt-lobed form *sensu* Makinson (2000: 41)

Seedling not seen. *Adult plants* stenobasic, fire-sensitive, dense *shrubs* 1.5–2.5 m high, 2–4 m wide with spreading to ascending branches; branchlets angular becoming rounded with age, with prominent ribs decurrent from the leaf bases extending down past lower nodes; youngest branchlets striate with ribs greenish (fewer hairs) or sometimes hairs with coppery tinges or not striate; indumentum dense, snow-white, greyish with age, the hairs biramous, mostly *medium*, straight or wavy, with some close-appressed and mutually aligned, some spreading to ascending. New growth soon greenish-white, very young shoots coppery. *Leaves* greyish, divided, 4.5–5.8 cm long, 3–4.5 cm wide, strongly ascending, sessile to shortly petiolate, subsecund, slightly incurved, crowded, obovoid in overall outline, subpinnatisect; proximal lobes simple or sometimes bi- or trisect; primary leaf lobes (3–)9–15, 1.5–4.5 cm long, 1.5–1.8 mm wide, linear, straight to slightly incurved, tetragonous in cross-section, the terminal lobe simple; proximal rachis segment 1.5–2.5 cm long, linear, sparsely hairy to glabrous abaxially on the petiole; apices of lobes obtuse with short blunt mucro *c.* 0.3 mm long; margin twice-refracted at right angles about longitudinal intramarginal veins, the remaining lamina enclosing most of the abaxial surface and almost abutting the midvein, the two sulcae *c.* 0.15 mm wide; adaxial surface flat, channelled and with regular raised ribs between the midvein and margin or irregular longitudinal wrinkling on either side of the midvein evident, with an open to dense indumentum of medium, appressed, white, wavy hairs, the proximal rachis segment similar with a dense indumentum of curled and spreading hairs on and just above the petiole; abaxial surface flat, bisulcate, the sulcae densely packed with short, curled or wavy hairs, the midvein glabrous or sometimes with a moderately dense indumentum of appressed wavy hairs; venation of adaxial surface with midvein and two intramarginal veins translucent, prominently raised and smooth or faintly granular, on the abaxial surface the midvein prominent, level with or slightly above the margin; texture coriaceous. *Conflorescence* 8–10.5 cm long, 1–2.5 cm wide, 3 cm high (*in vivo*) from rachis to style-ends, terminal or more usually subterminal, erect on the peduncle

and striking an obliquely ascending angle relative to the branchlet, simple or sometimes the terminal confluence 1–3-branched from base, shortly pedunculate, conico-secund, dense, acropetal; buds at 1.5 cm long, *c.* 2.2 mm wide, cylindrical; peduncles usually bracteate, 1–2 cm long, snowy white to grey, sericeo-tomentose, the hairs biramous; floral rachises 3 mm thick at base, white, sub-villous, the apical 1 cm frequently without flowers by abortion of buds; confluence bracts *c.* 3 mm long, ovate; floral bracts *c.* 1.5 mm long, 1.5–2 mm wide, sericeous outside with a mixture of white and ferruginous hairs, very broadly obovoid to sub-elliptic with strongly incurved apex, glabrous inside, caducous as the confluence expands, some persistent at anthesis. *Flowers* in bud with the limb white to pale brown distally sometimes with red hairs intermixed, white proximally; at anthesis perianth outside snowy white to whitish red, limb whitish red to red-brown, perianth inside red to dark red; style and style-end currant red (RHS 46A); pollen-presenter orange-red; nectary creamy-yellow; orientation in bud adaxially acroscopic, at anthesis acroscopic, post-anthesis adaxially acroscopic; pedicels 2–2.5 mm long, *c.* 1 mm wide at base, 1.5 mm wide below the torus, recurved to erect at anthesis, strongly antrorse post anthesis, stout, obovoid, tomentose; torus *c.* 1.75 mm across, slightly oblique to *c.* 10°; nectary 1.3–1.4 mm long, *c.* 1.25 mm wide, *c.* 0.4 mm thick, patelliform-linguiform, concave proximally, extending *c.* 0.3 mm laterally beyond the torus, apex truncate to broadly acute, recurved with age. *Perianth tube* 6.5–8 mm long, 2–2.5 mm wide at base, *c.* 1.5 mm wide at curve, zygomorphic, obliquely ovoid-sigmoid, dilated slightly at base, the abaxial surface with a dense biramous indumentum, the hairs medium, dull, sinuous, antrorsely spreading at *c.* 10°–20°, the adaxial surface glabrous; limb 1.8–2.25 mm long, 1.8–2.5 mm wide, spheroidal, symmetrical, closely declined to declined-revolute, flowers on the left side of the rachis sinistrally displaced at anthesis, those on the right dexterously displaced, the hairs medium-long bearing pale, fawnish-brown contents, the style-end tightly enclosed before anthesis, all tepals separating and quickly falling after anthesis; dorsal tepals *c.* 10.25 mm long, 1.5 mm wide at base, 0.5–0.7 mm wide at curve. *Pistil* 22–24.5 mm long; stipe *c.* 0.2 mm long, subvillous, the portion enclosed in the torus glabrous; ovary *c.* 1 mm long, *c.* 1.5 mm wide, obliquely ovoid, subsessile, densely subvillous with hairs long, straight, white, slightly spreading; style strap-like *in sicco*, terete *in vivo*, *c.* 0.7 mm wide at the curve, gradually dilated to 0.9 mm just below the style-end, usually glabrous, occasionally with scattered minute trichomes of uncertain type at the curve on the ventral side, emergent and looped up before anthesis, gradually incurved at anthesis, strongly retrorse from halfway to sigmoid soon after anthesis, ultimately the proximal half of the style antrorse and slightly oblique to almost parallel with the rachis, the distal courving unchanged; style-end abruptly divergent 0.7 mm below the end and expanded to *c.* 1.6 mm in width, glabrous; pollen-presenter 1.5–1.6 mm long, *c.* 1.25 mm wide, oblique at 10°–30°-encircled by an undulate style-end *in sicco*, oblong-elliptic, convex with one prominent radial rib extending proximally from the stigma and a few distal ribs faintly raised; stigma prominent, oblique, annular, distally off-centre, surrounded by minute trichomes. *Fruits* 14–17 mm long, 6–7 mm deep, erect on strongly incurved pedicels, the dorsal suture adjacent to the rachis during the growth phase, ultimately rotating on its axis away from the rachis before dehiscence, obliquely ovoid to oblong-ellipsoid with erect or decurved apical attenuation *c.* 2 mm long; styles persistent; abaxial surface openly sericeous, longitudinally ribbed on the dorsal side, with irregular, longitudinal, dark reddish-purple stripes predominant toward the dorsal side; surface beneath the indumentum slightly irregular and somewhat colliculose; adaxial surface smooth; pericarp 0.4–0.5 mm across at the suture, texture crustaceous. *Seeds* 8–10 mm long, 4–4.5 mm wide, 1.7–2 mm thick, obovoid-elliptical with a curved outer edge and straight inner edge; abaxial face convex, glossy, almost smooth or slightly wrinkled, consisting of a central elliptic portion 7 mm long, 2.5 mm wide surrounded by a darker narrow rib-like border 0.25 mm wide and an outer, lighter-coloured margin 0.5–1 mm wide along the sides, up to 0.7–1 mm wide on the ends; adaxial face with an inner, flat, minutely tessellated, elliptic segment 6–7 mm long, 1.5–2 mm wide, surrounded by a raised border *c.* 0.5 mm wide, the border with an irregular and sometimes vertically descending outer margin and all surrounded by a creamy-white waxy border *c.* 0.5 mm wide along the sides, *c.* 1 mm wide at base, the elaiosome 1–1.5 mm long and drawn to an obtuse point at the apex. (Figures 3, 4)

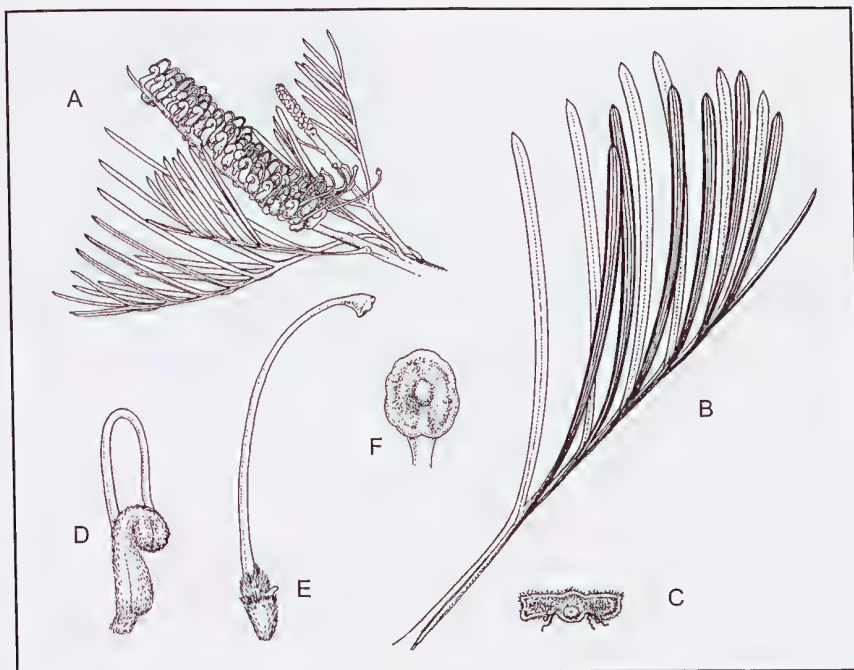


Figure 3. *Grevillea nivea*. A—confluence and bud with foliage ($\times 0.5$); B—leaf ($\times 2$); C—cross-section of leaf lobe ($\times 10$); D—perianth and style prior to anthesis ($\times 2$); E—pedicel and pistil ($\times 2$); F—pollen-presenter ($\times 9$). Illustrations by Margaret Pieroni.



Figure 4. *Grevillea nivea* in cultivation, October 2008, at 'Silky Oaks', Oakdale, New South Wales.

Selected specimens (9 examined). WESTERNAUSTRALIA: Gairdner River, 28 July 1963, *J.S. Beard* 2564 (KPBG); cultivated Botanic Gardens (?Sydney), Nov. 1909, *J.L. Boorman s.n.* (NSW 92138); Hood Point, Bremer Bay, 1 Jan. 1993, *J.M. Cullen* 92098 (NSW 273561); Bremer Bay, high sandstone heath, 1 Nov. 1943, *C.A. Gardner* 6578 (PERTH 02142910); Doubtful Is. [Island] Penin[sula], undated, *Anon. [G. Maxwell]* 246 (MEL 64565, MEL 64566); Doubtful Island Bay, undated, *Oldfield s.n.* (MEL 64568); Bremer River, 1884, *W. Webb s.n.* (MEL 64569); Bremer Bay, S Coast, Sep. 1897, *J. Wellstead s.n.* (CANB 327763).

Distribution. Western Australia, South-west Botanical Province, Esperance Plains IBRA Region, southern coast between Point Hood and Gairdner River. (Figure 2)

Habitat. Occurs as a dominant in open, low, windswept heath on hillside among granite rocks close to the coast.

Flowering period. Spring.

Fruiting period. Late spring–summer

Conservation status. Conservation Code for Western Australia: Priority Two.

Etymology: The specific epithet is derived from the Latin, *niveus* – snow-white, in reference to the branchlet, perianth and floral rachis indumentum.

Discussion. *Grevillea nivea* may be best summarised in terms of the following characters; branchlets snowy-white, the hairs medium in length, mostly appressed but some spreading, biramous; leaves greyish, divided, never simple, with 9–15 closely-aligned, linear lobes, the proximal rachis segment 1.5–2.5 cm long; leaf lobes 1.5–4.5 cm long, 1.5–1.8 mm wide, the proximal lobes simple to bi- or trisect, the adaxial surface with a moderately dense indumentum of medium, biramous hairs; the abaxial surface flat, the midvein and intramarginal veins equally prominent in cross-section; margin twice-refracted at right angles, the ultimate refraction level with the midvein; sulcae beside the midvein on the abaxial surface of leaf lobes *c.* 0.15 mm wide, densely covered in wavy hairs; apices of lobes obtuse with mucros *c.* 0.3 mm long; floral bracts *c.* 1.5 mm long, 1.8–2 mm wide; floral rachises, pedicels and base of perianth lacking white waxy globules or irregular glandular excrescences in the indumentum; principal flower colour red; floral rachis snow-white; perianth indumentum snow-white, antrorsely spreading; perianth limb white with a few brownish hairs; style glabrous.

The morphological characters that best summarise *Grevillea tetragonoloba* are: branchlets with hairs non-white, usually creamy-brown or honey-coloured, with an indumentum of short, appressed, biramous and glandular hairs intermixed; leaves usually green, occasionally grey-green, rarely simple, usually divided with 5–7(–8) loosely spreading to aligned, narrow-linear lobes, the proximal rachis segment 3–5 cm long; leaf lobes 3–8 cm long, 0.8–1.5 mm wide, the proximal lobes simple, the adaxial surface subglabrous or with a sparse, mixed indumentum of short, biramous and glandular hairs, the abaxial surface usually angularly concave, the midvein recessed below the intramarginal veins; margin twice-refracted, the first refraction at right angles, the ultimate refraction usually oblique; sulcae beside the midvein on the abaxial surface of leaf lobes scarcely evident to very fine, *c.* 0.05 mm wide, hairs either not visible or, occasionally, appressed straight hairs visible; apices of lobes acute, with mucros 0.5–0.7 mm long; floral bracts *c.* 0.8 mm long, 1 mm wide; floral rachises, pedicels and perianth (especially at base) with waxy globules or irregular glandular excrescences in the indumentum;

principal flower colour orange-red; floral rachis with rusty striations; perianth indumentum creamy-fawn; perianth limb rusty; style with few to many, minute glandular hairs. The branchlet, perianth and floral rachis indumentum is predominantly creamy fawn with glandular hairs intermixed in *Grevillea tetragonoloba* cf. bright, snow-white and exclusively biramous in *Grevillea nivea*.

The large number of morphological discontinuities evident from the summaries above suggest that *Grevillea nivea* is best recognised at specific rank, rather than as a subspecies of *Grevillea tetragonoloba*, notwithstanding its previous inclusion in that species as a race. Although greyish-leaved specimens of *Grevillea tetragonoloba* show some approach to *Grevillea nivea*, there are no morphological intermediates between the species, both of which otherwise have relatively uniform morphology and occur in self-reproducing, stable populations. Grey-leaved specimens of *Grevillea tetragonoloba* in the east of that species' range are unlikely to represent a separate subspecific taxon, though more collections and field work to examine its morphology, its distribution and population basis are needed. Specimens representative of this foliar variant in every other respect fall within the morphological boundaries of *Grevillea tetragonoloba*, especially in the presence of glandular hairs on branchlets, leaves and confluences, waxy globules on the floral rachis and floral indumentum and in the smaller number of longer and narrower leaf lobes. These white, waxy globules, presumably a glandular exudate, represent an autapomorphic character state, not only in relation to *Grevillea tetragonoloba sensu* McGillivray or even the wider group of related species (Group 35 *sensu* Olde & Marriott) but also to the whole genus *Grevillea*, so far as we are aware. Absence of glandular hairs and their waxy globular exudate from the floral indumentum is therefore seen as significant in the recognition of *Grevillea nivea*. Glandular exudates are usually resinous, even in the most closely related species.

Grevillea nivea is an allopatric, geographic isolate, disjunct from *Grevillea tetragonoloba* in both distance and habitat. Population size requires assessment but at least 100 plants were seen by us at Hood Point. In distance, the taxa grow within 50 km of each other but *Grevillea nivea* is found in more exposed, subcoastal situations whereas *Grevillea tetragonoloba* occurs further inland along drainage lines and close to fresh-water river systems between the Pallinup River and West River. Both species are granite-loving and prefer to grow in granite-derived sand.

Horticultural note. Roach (2005) alludes to the outstanding horticultural potential of *Grevillea nivea* and suggests methods of cultivation. It is sold often as *Grevillea* 'Scarlet King'.

Key to related species

The following key involves a slight amendment to the *Key to Species for Group 35* (Olde & Marriott 1994d: 217–218), by insertion of an additional couplet.

- 25 Leaf lobes flexuose, terete in cross-section; style pinkish-maroon **G. wittweri**
- 25* Leaf lobes straight, quadrangular in cross-section; style red or orange-red
- 26 Perianth limb silky to silky-tomentose; widest confluence buds 2 mm wide, cylindrical; fruits with glandular hairs absent or very occasional
- 27 Glandular hairs present on branchlets, leaves and confluences; floral rachis, pedicels and perianths with many waxy deposits; leaf lobes 5–8, 4.5–5.8 cm long, 0.8–1.1 mm wide, the margin tightly abutting the midvein on the abaxial surface **G. tetragonoloba**

- 27* Glandular hairs absent from branchlets, leaves and confluences; floral rachis lacking ferruginous striations; floral rachises, pedicels and perianths lacking waxy deposits; leaf lobes 9–15, 1.5–4.5 cm long, 1.1–1.5 mm wide, the abaxial surface exposed beside the midvein in two sulcae c. 0.15 mm wide.....**G. nivea**
- 26* Perianth limb villous; widest confluence buds 4 mm wide, ovoid; fruits with few to numerous glandular hairs
- 27a Floral rachis with white hairs; torus > 1 mm across; widest leaf lobes \geq 1.3 mm wide; fruit with scattered glandular hairs; branchlets not yellow; leaves not fastigate.....**G. rigida**
- 27a* Floral rachis rusty; torus c. 0.8 mm across; widest leaf lobes \leq 1.2 mm wide; fruit with glandular hairs predominant; branchlets yellow; leaves fastigate.....**G. fastigiata**

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